

REMARKS

Applicants thank the Examiner for the very thorough consideration given the present application. Claims 1-18 and 20 are now pending in the application. Claim 20 has been added. Claims 1, 7, 11 and 15 are amended. Claim 19 is canceled without prejudice to the subject matter contained therein. The Examiner is respectfully requested to reconsider and withdraw the rejection(s) in view of the amendments and remarks contained herein.

In addition, applicants also thank the Examiner for the courtesy extended during the telephonic conference on November 19, 2003 in which only the Examiner and applicants' undersigned attorney Anthony G. Fussner participated. During the telephonic conference, the Examiner and the undersigned attorney discussed Flonc, U.S. Patent No. 5,080,851 as applied to claims 1-18 without reaching an agreement on allowable subject matter.

RESTRICTION REQUIREMENT

Applicants hereby affirm the provisional election with traverse to prosecute claims 1-18. Applicants cancel claim 19 without prejudice to the subject matter contained therein.

SPECIFICATION

The specification is amended to correct obvious typographical and scrivener errors. No new matter is introduced by the amendment of the specification.

REJECTION OF CLAIMS 1, 2 AND 4-6 UNDER 35 U.S.C. § 102 AND § 103

Claims 1, 2 and 4-6 are rejected under 35 U.S.C. § 102(b) as being anticipated by Flonc (U.S. Patent No. 5,080,851) or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Flonc in view of Crane (U.S. Patent No. 4,695,344). This rejection is respectfully traversed.

The present invention relates to methods and systems in which two or more independent dry fiber preforms are bonded together to form a composite laminate structure. In preferred embodiments, the preforms, which are formed of a plurality of fiber layers, are assembled with adhesive along only the bond line(s) or interface(s) between the preforms. That is, the adhesive is sandwiched between only those opposing surfaces of the preforms that are to be bonded together, and the adhesive is not disposed between the fiber layers forming any one preform. Assembly of the preforms is preferably accomplished with the preforms resting on a tool of a conventional vacuum assisted resin transfer molding apparatus. An airtight structure, for example, a vacuum bag, is then placed over the entire structure. The vacuum bag has at least one opening which is in communication with a reservoir filled with resin and at least one opening which is in communication with a vacuum generating source. The entire assembly is heated to a temperature sufficient to cause the adhesive to become viscous and to migrate (i.e., flow) into the plies or layers of each of the preforms. A vacuum force is preferably generated at this time which further assists in causing the viscous adhesive to migrate and thoroughly "wet" several plies of each preform at those areas where the adhesive has been placed. When it is determined that satisfactory wetting of the dry fiber preforms with the adhesive has occurred, resin from the resin reservoir is admitted into the airtight enclosure and drawn through each of the preforms to thoroughly wet each of the preforms. The

resin substantially fills the microscopic pockets and interstices around each fiber in those plies which the adhesive has wet. This strengthens the bond line at those areas that are being joined by the adhesive. The entire assembly is then allowed to cure before being removed from the tool. Once removed, the preforms form a rigid, single piece composite laminate structure, such as a composite skin panel having improved stiffener pull-off or pull away strength.

Advantageously, the bonding of the independent dry fiber preforms and the subsequent infusion of resin into each of the preforms can be accomplished in a single manufacturing operation, as recited in claim 20. The joint produced at the bond line(s) of the preforms is enhanced due to the increased migration of the viscous adhesive into the plies of each of the preforms at those areas where bonding has taken place. The resulting joint formed at the bond line of the two preforms is stronger than what would be formed simply by adhering two otherwise completely formed preforms together because the dry fiber preforms, in connection with the heating of the preforms, allow wetting of several plies of each of the preforms at the joint area, rather than just the surface ply of each preform.

To this end, independent claim 1 recites a method for forming a composite laminate structure comprising providing a first dry fiber preform having a plurality of layers of fiber material, placing a thin film adhesive material against only a surface of said first dry fiber preform which is to be bonded to an opposing surface of a second dry fiber preform having a plurality of layers of fiber material, placing the second dry fiber preform against said adhesive material to thereby sandwich said thin film adhesive material between only the opposing surfaces of said dry fiber preforms and thereby form a composite laminate assembly, placing said composite laminate assembly within an airtight enclosure, heating said thin film adhesive material and

said dry fiber preforms to a temperature sufficient to cause said thin film adhesive material to become viscous, causing said viscous adhesive to flow into a subplurality of layers of each of said dry fiber preforms to at least substantially saturate a subplurality of said layers of each of said dry fiber preforms, and after said subplurality of said layers of said dry fiber preforms are substantially saturated with said viscous adhesive, then infusing a resin into each of said dry fiber preforms to thoroughly wet said dry fiber preforms.

In contrast, Flonc discloses a process in which resin 4 is placed between each corresponding pair of layers 1. See column 3, lines 12-13, and FIG. 1. Flonc clearly does not disclose a method including "placing a thin film adhesive material against only a surface of said first dry fiber preform which is to be bonded to an opposing surface of a second dry fiber preform having a plurality of layers of fiber material", and "placing the second dry fiber preform against said adhesive material to thereby sandwich said thin film adhesive material between only the opposing surfaces of said dry fiber preforms and thereby form a composite laminate assembly", as required by claim 1. For at least this reason, the rejection of claims 1, 2 and 4-6 should be withdrawn.

Further, applicants have also not found any disclosure, teaching or remote suggestion in Crane of a method in which an adhesive is disposed along only the bond line(s) or interface(s) between dry fiber preforms. Indeed, Crane FIG. 1 appears to show only one dry fiber preform 3 which is sandwiched between two sheets of cut resin 1.

Flonc and Crane also fail to recognize the unobvious advantages that can be realized by the methods of the present invention. For example, neither reference recognizes that the joint produced at the bond line(s) or interface(s) of the preforms

is enhanced due to the increased migration of the viscous adhesive into the layers of each preform at those areas where bonding has taken place. The cited references also do not recognize that the resulting joint is also stronger than what would be formed simply by adhering two otherwise completely formed preforms together because the dry fiber preforms, in connection with the heating of the preforms, allow wetting of several layers of each preforms at the joint area, rather than just the surface ply of each preform.

For at least the above reasons, applicants respectfully submit that the cited references do not anticipate or render obvious claims 1, 2, and 4-6. Accordingly, the Patent Office is respectfully requested to reconsider and withdraw the section 102 and 103 rejections of claims 1, 2, and 4-6.

REJECTION OF CLAIM 3 UNDER 35 U.S.C. § 103

Claim 3 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Flonc as applied to claim 2 above and further in view of Setiabudi (U.S. Patent No. 5,840,238). This rejection is respectfully traversed.

Claim 3 depends from claim 2, which, in turn, depends from independent claim 1. Thus, claim 3 is allowable over the cited references for at least the same reasons as those presented above with respect to claims 1 and 2.

REJECTION OF CLAIMS 7-11 AND 15-17 UNDER 35 U.S.C. § 103

Claims 7-11 and 15-17 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Flonc as applied in claim 1 above and further in view of Crane and McClure (U.S. Patent No. 6,555,045). This rejection is respectfully traversed.

Claims 7-10 are directed to a method for forming a composite laminate structure. Claims 7-10 require “placing a layer of thin film adhesive against only a surface of a corresponding surface layer of said layers of said first dry fiber preform” and “placing a second dry fiber preform having a plurality of layers of fiber material against said thin film adhesive layer to thereby sandwich said thin film adhesive layer between the corresponding surface layer of said first fiber preform and an opposing surface layer of said layers of said second dry fiber preform and thereby form a composite laminate assembly.”

Claims 15-17 are directed to a method for forming at least a pair of independent dry fiber preforms into a composite laminate structure. Claims 15-17 require “disposing a thin film adhesive layer between a surface of one of said dry fiber preforms and an opposing surface of the other of said dry fiber preforms such that said adhesive layer is sandwiched between only the opposing surfaces of said dry fiber preforms.”

As described in detail above, however, Flonc discloses a process in which resin 4 is placed between each corresponding pair of layers 1. See column 3, lines 12-13, and FIG. 1. Flonc clearly does not disclose a method in which an adhesive is disposed along only the bond line(s) or interface(s) between dry fiber preforms.

Further, applicants have also not found any disclosure, teaching or remote suggestion in Crane or McClure of a method in which an adhesive is disposed along only the bond line(s) or interface(s) between dry fiber preforms.

Given that Flonc, Crane, and McClure fail to even remotely disclose or suggest each of the methods steps recited in claims 7-11 and 15-17, the rejection of these claims should be withdrawn. For these reasons, the Patent Office is

respectfully requested to reconsider and withdraw the § 103 of claims 7-11 and 15-17.

REJECTION OF CLAIMS 12-14 UNDER 35 U.S.C. § 103

Claims 12-14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Flonc, Crane and McClure as applied to claim 7 above and further in view of Setiabudi. This rejection is respectfully traversed.

Claims 12-14 depend from claim 7 and are therefore allowable over the cited references for at least the same reasons as those presented above with respect to claim 7.

REJECTION OF CLAIM 18 UNDER 35 U.S.C. § 103

Claim 18 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Flonc, Crane and McClure as applied to claim 15 above and further in view of Setiabudi. This rejection is respectfully traversed.

Claim 18 depends from claim 15 and is therefore allowable over the cited references for at least the same reasons as those presented above with respect to claim 15.

CLAIM 20

New claim 20 is directed to a method for forming at least a pair of independent dry fiber preforms into a composite skin panel in a single manufacturing operation. For at least the following reasons, claim 20 is believed to be allowable over the cited references.

Claim 20 requires “disposing an adhesive only at an interface of said dry fiber preforms.” As described in detail above, Flonc discloses a process in which resin 4 is placed between each corresponding pair of layers 1. See column 3, lines 12-13, and FIG. 1. Flonc clearly does not disclose a method in which an adhesive is disposed along only the bond line(s) or interface(s) between dry fiber preforms. Further, applicants have also not found any disclosure, teaching or remote suggestion in the other cited references of a method in which an adhesive is disposed along only the bond line(s) or interface(s) between dry fiber preforms.

In addition, Flonc merely discloses a process for bonding layers 1 to form a storable preform 3 which can be stored and then later cut and shaped, in separate processes, to form a composite part. See column 3, lines 17-22. Flonc clearly does not disclose a process in which two or more independent dry fiber preforms are bonded to one another to form a composite laminate structure in a single manufacturing operation. Indeed, Flonc teaches away from a single manufacturing operation by touting advantages associated with being able to store the preform 3 for subsequent cutting and shaping processes.

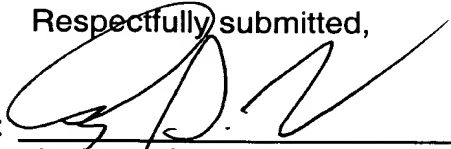
CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will

expedite prosecution of this application, the Examiner is invited to telephone the undersigned directly at (314) 726-7502.

Respectfully submitted,

By:



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Dated: November 20, 2003

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